Appendix B
Seawall Evaluation Report
(Previously submitted to USACE)

Seawall Evaluation Report
Kinnickinnic River, Wisconsin
Milwaukee Estuary Area of Concern
Sediment Removal Concept Design

Prepared for
U.S. Army Corps of Engineers
Detroit District

July 2003

BARR

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Kinnickinnic River
Seawall Evaluation Report
Milwaukee, Wisconsin

Source: USACE & WDNR. April 7, 2004. Kinnickinnic River, Wisconsin - Milwaukee Estuary of Concern - Deepening/Remediation Concept Design Documentation Report. Appendix B

Source: USACE & WDNR. April 7, 2004. Kinnickinnic River, Wisconsin - Milwaukee Estuary of Concern - Deepening/Remediation Concept Design Documentation Report. Appendix B

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Source: USACE & WDNR. April 7, 2004. Kinnickinnic River, Wisconsin - Milwaukee Estuary of Concern - Deepening/Remediation Concept Design Documentation Report. Appendix B

1.0 Introduction

The purpose of this report is to qualitatively assess the condition of the existing seawalls along a portion of the Kinnickinnic River in Milwaukee, Wisconsin, and assess whether dredging the river in the vicinity of these walls would adversely affect their stability. There are two questions addressed in this report. The first question is; will dredging the river adversely affect the stability of the existing seawalls? If the answer to this question is yes, then, what can be done to strengthen the walls as needed to accommodate the excavation?

Recommendations and conclusions are based on field observations, available construction records, and conceptual design computations based on broad assumptions, which are provided in Appendix B. No new detailed analyses have been completed for this report. Additional information may be required after the limits of the channel dredging are finalized.

2.0 Project Background

The project area is a portion of the lower Kinnickinnic River in Milwaukee, Wisconsin between Becher Street (upstream) and the Kinnickinnic Avenue Bridge (downstream). A site map of the area is included in Figure 1.

The Kinnickinnic River is located within the Milwaukee Estuary Area of Concern (AOC) in Milwaukee, Wisconsin. The lower Kinnickinnic River is slowly making the transition from industrial use to recreational and commercial uses. Sediment studies in the portion of the Kinnickinnic River located between Becher Street (upstream) and Kinnickinnic Avenue, identified elevated levels of PCBs (45 ppm) and PAHs (~1,000 ppm). Near record low Lake Michigan water levels have caused many areas in this River segment to be completely exposed and available to direct human and wildlife contact. Water depths over the remaining sediments vary, but are generally very shallow. The exposed sediments along with increased recreational boating traffic on the River also add to the possibility of contaminant contact. The area has received increased attention as a result of discussions between federal, state and local governments and adjacent landowners regarding the need to deepen the river for navigation as well as implement remediation.

The Wisconsin Department of Natural Resources (WDNR) has proposed to remove sediments within this portion of the Kinnickinnic River (from upper limit of Federal navigation channel to Becher Street Bridge, approximately 1,450 linear feet) to address the contaminant contact issue with a view toward optimizing recreational and navigation opportunities. The WDNR requested U.S. Army Corps of Engineers (USACE) assistance for the planning and engineering portion of this effort under the Great Lakes RAP (GLRAP) program. An agreement to provide the assistance was executed August 13, 2002.

As part of this sediment removal project, the existing seawalls along the portion of the river in question were evaluated to assess whether dredging the river would adversely affect these walls.

3.0 Description of Project Features

3.1 General

Project descriptions are based on a field inspection performed by Barr Engineering on October 4, 2002 and a review of Milwaukee Port Authority records including construction permits, record drawings, and past inspection reports. The Port Authority provided copies of permits and records as outlined on their dock line maps. These map drawings were titled, "Dock Line Map 28 Showing Navigable Rivers and Canals of the City of Milwaukee," "Dock Line Map 29 Showing Navigable Rivers and Canals of the City of Milwaukee," and "Dock Line Map 30 Showing Navigable Rivers and Canals of the City of Milwaukee." The Port Authority also provided a copy of 1990 inspection reports on City-owned and privately owned dock walls, prepared by Lawrence E. Sullivan, Harbor Engineer. The field inspection was performed by viewing the walls from a boat within the river. The Port Authority provided the boat and boat operators to assist Barr's engineer with the inspection.

The portion of the Kinnickinnic River in question is partially lined with various types of seawalls. The river length in question is approximately 1800 feet long with about 3600 feet of river bank. Approximately 2200 feet of the river bank is lined with seawalls. The exact extent of the walls is unknown, thus, approximations were made from available drawings and photographs. General photographs are included with this report in Appendix A. The remainder of the river bank is either unprotected by walls or protected by bridge abutments. The wall types are steel sheet pile (SSP), Wakefield timber, Wakefield timber with concrete cap, and concrete. There are several stretches of the riverbank that have no wall whatsoever. References to left and right assume an orientation while looking downstream. The following list of words and definitions were used for this report.

- Poor: Severe deterioration, loss of section, extensive corrosion or rotting, and signs of movement from seawall deterioration.
- Fair: Some deterioration, corrosion or rotting.
- Good: Minimal to zero deterioration, corrosion or rotting.
- Excellent: Like new with no deterioration whatsoever

3.2 Description of Walls

As mentioned above, there are four types of seawalls in question. The walls range in age from nearly 100 years old to new. In general, the SSP walls were observed to be in good condition. Old timber and concrete capped timber walls are in poor condition, and the one section of concrete wall appears to be in good condition. A detailed description of the walls, relative to land parcel location is included below. The land parcel numbers referenced are those used by the Milwaukee Port Authority. A site map showing the land parcel layout is included in Figure 2. For the purposes of this report, the order of the descriptions will begin upstream at Becher Street and proceed downstream along the left river bank until the project

limit is reached. Then the descriptions will begin again upstream at Becher Street and proceed downstream along the right river bank.

3.2.1 SSP Wall along Parcel Number 429

The wall along this parcel is an anchored SSP wall approximately 385 feet long. According to permits 104-C and 128-C the wall is 34 feet deep and was constructed in 1936 and 1941. The wall appears to be in good condition with no visible settlement or movement. There are permanent boat slips constructed on 9-inch pipe piles driven into the river bottom along the wall. A concrete box stormwater outlet at the upstream end of the property is in good condition.

3.2.2 River Bank Along Parcel Number 428

This 83-foot stretch of the river shore is unprotected. Records indicate a Wakefield timber wall along this river bank constructed in 1902. If the wall remains, it could not be seen from a boat within the river during the site inspection.

3.2.3 River Bank Along Parcel Number 427

This 256-foot section of the river is unprotected. Records indicate the portion of this parcel facing east to have a Wakefield timber wall along the river bank constructed in 1902. This is a continuation of the same wall as Parcel 428. Records also indicate the portion of this parcel facing south to have a Wakefield timber wall constructed in 1943. Permit 134-R indicates Wakefield sheets that are 28 feet long with 50 foot long supporting piles. Some remnants of this wall are visible; however, for the most part this parcel is unprotected and the river bank is contained by vegetation.

3.2.4 Timber Structure along Parcel Number 426B

Records for this 292-foot stretch of river bank indicate a Wakefield timber wall constructed in 1941 and/or 1943. Construction permit 131-R for this parcel does not provide details for the wall; however, it may be speculated that the wall is of similar depth as Parcel 427 that is 28 feet. The existing visible structure appears to be a timber dock built along the river bank with 12x12 square members. This structure sits on top and adjacent to the Wakefield timber wall constructed in the 1940's. The wall itself was not visible. The visible timbers of the dock superstructure appear to be in fair condition with minimal deterioration. Additionally, vegetation is growing out from the river bank beneath the timber dock.

3.2.5 Timber and Concrete Structure along Parcel Number 426A

Records for this 385-foot section of the river indicate a Wakefield timber wall constructed in 194 and 1942. Most of this wall is permitted under Permit Number 131-R. The downstream most 90 feet is covered under Permit 138-R which indicates 28-foot long Wakefield timbers and 50-foot timber support piles. There is a concrete dock built on top and adjacent to the old wall. The concrete dock is not detailed on available records. In general, the wall and dock appear to be in fair to good condition, however, much of the Wakefield timber wall was not visible. There are no visible signs of distress or movement in the wall. Some spalling and deterioration of the concrete is present.

3.2.6 1st Street Bridge Abutment at Parcel 426

The left bridge abutment for the 1st Street Bridge is the river bank along Parcel 426. The abutment consists of a SSP wall and mass concrete section. The abutment is in excellent condition.

3.2.7 Walls and River Bank Along Parcel Number 425

Records for this 693-foot section of the river bank between the 1st Street Bridge and the Kinnickinnic Avenue Bridge indicate that no wall exists. However, some portions of this parcel are lined with a timber wall or timber and concrete wall. Roughly 150 feet of this river bank is protected by some sort of timber wall and another roughly 150 feet is protected by a timber and concrete wall. Both sections of wall are in poor condition with rotted wood and spalling concrete at the waterline. The remainder of the river bank within this parcel is unprotected with the river bank contained by vegetation. There is also an old railroad bridge abutment near the downstream end of the parcel just upstream from the Kinnickinnic Avenue Bridge. The abutment is mass concrete and there is some spalling and deterioration of the concrete.

This is the end of the parcels along the left river bank. The following paragraphs describe the parcels along the right river bank.

3.2.8 SSP Wall along Parcel 432

An anchored SSP wall constructed in 1990 protects this 51-foot stretch of riverbank. The wall is in excellent condition. Permits were not available for this parcel.

3.2.9 SSP Wall along Parcel 433

This 556-foot section of the river is lined with an anchored SSP wall constructed in 1969 and 1990. Permits 208-C and 219-C indicate the wall is either 46 feet deep or 25 feet deep. The wall is in good condition with no visible signs of movement or distress. This parcel is adjacent to a bend in the river where the river turns from flowing north to flowing east. 349-feet of the parcel face west and 210-feet face north.

3.2.10 River Bank along Parcel 436

This 233-foot stretch of river bank is unprotected. There are no records indicating that this area was ever lined with a wall. The river bank is contained by vegetation and debris.

3.2.11 Concrete Wall along Parcel 437

A concrete dock wall lines the shore along this 152-foot section of the river. The wall is in generally good condition with some spalling and cracking. Records indicating the age or design of this wall are not available.

3.2.12 1st Street Bridge Abutment at Parcel 438

The right bridge abutment for the 1st Street Bridge is the river bank along Parcel 438. The abutment consists of a SSP wall and mass concrete section. The abutment is in excellent condition.

3.2.13 River Bank along Parcel 439

There is no wall along this 238-foot stretch of the riverbank. This parcel starts upstream at 1st Avenue and extends 238-feet downstream to an old railroad bridge abutment. Records indicate a Wakefield timber wall was constructed in this area in 1901. There are no visible signs of this wall. Most of the river bank is contained by vegetation and debris.

3.2.14 River Bank along Parcel 440, 441, 442, and 443

This 519-foot section of the river bank is mostly unprotected. These parcels are located downstream consecutively from Parcel 439. Records indicate a Wakefield timber wall constructed in the early 1900's, but there are no signs of this wall. Immediately upstream from the abandoned railroad bridge abutment at Parcel 440, a new SSP wall is being constructed. It is not known if this is a new permanent structure or a cofferdam for work being completed along the shore behind the wall. Also in this river stretch is a concrete railroad bridge pier and timber guidewall along about 200-feet in front of Parcels 442 and 443. The wall is in the middle of the river to protect the bridge pier adjacent to Parcel 442. There is a sign on this wall indicating fiber optic lines in the vicinity. The river bank is behind this wall about 50 to 100 feet and is contained by vegetation. The majority of the river bank in these parcels is contained by vegetation.

3.3 Planned Improvements or Existing Permits

The author is not aware of any planned improvements to the seawalls in this stretch of the Kinnickinnic River. There is one existing construction project ongoing. As mentioned in Paragraph 3.2.14, a new SSP wall is being constructed along Parcel 440. However, this project is not permitted with the Port Authority.

4.0 Conclusions

4.1 General

Based on a visual inspection of the walls and a review of available records, the following paragraphs address the question, "will dredging adversely affect the stability of the existing structure?" These conclusions are conceptual and qualitative and are based on general assumptions and engineering expertise. Detailed analyses have not been completed for this report, a preliminary seawall stability analyses is provided in Appendix B. The following assumptions were used for this report.

- 6 to 8 feet of sediment would be removed.
- Dredge channel limits not closer than 10-feet to any structure based on preliminary stability analyses.
- Submerged portions of more recently constructed walls are in good condition.
- Buried portions of more recently constructed walls, anchor walls, and anchor rods in good condition.

The conclusions are listed according to type of structure with parcel numbers referenced appropriately.

4.2 SSP Walls

The SSP walls are in good to excellent condition and appear stable under their current loading conditions. This type of structure is found in all or portions of Parcels 429, 432, 433, 438, and 439. These walls would likely not be affected by dredging the river bottom provided the dredging meets the limitations outlined above and unseen portions of the wall are in good condition. If the limits of the dredging are more extensive than assumed here, additional work is required as detailed in Section 5.0.

4.3 Wakefield Timber Walls

The Wakefield timber walls as shown on records and observed were either in poor condition or no longer in existence. These walls were found on all or portions of Parcels 425, 426A, 426B, 440, 441, 442, and 443. For the walls immediately lining the river in Parcels 425, 426A and 426B, dredging the channel would likely have a negative effect on these walls due to their poor condition, age, and because records indicate they are not embedded as deeply as more recent SSP walls. For the walls either missing or far inland from the river bank as found in Parcels 440 through 443, dredging would not affect these sections of the river bank. Recommendations for stabilizing or strengthening these walls during dredging are included in Section 5.0.

4.4 Wakefield Timber Walls with Concrete Cap

These walls found on Parcels 425, 456A, and 426B were also found to be in poor condition with limited embedment shown on records, and therefore, dredging would likely have a negative effect similar to

Paragraph 4.3. The recommendations for stabilizing or strengthening these walls are the same as Paragraph 4.3 and are found in Section 5.0.

4.5 Concrete Wall

There is one short portion of the river bank that has a concrete dock wall. This is the 152-foot section of Parcel 437. Detailed records were not available for this wall. However, it appears to be in good condition. It is unlikely that dredging would adversely affect this wall provided the limitations outlined above are followed. However, further analysis may be warranted if it is determined that this wall is a concrete cap on piles. If the limits of the dredging are more extensive than assumed here, additional work is required as detailed in Section 5.0.

4.6 Miscellaneous Structures

There are additional miscellaneous structure along this stretch of river that are included below although they are not seawalls or critical to seawall stability. They are included for informational purposes.

4.6.1 Timber Pile Fence

On the right side of the current navigation channel starting at the Kinnickinnic Avenue Bridge and extending upstream 204-feet is an old timber pile protective fence constructed in 1962. It was constructed to protect a railroad concrete bridge pier within the river from barge traffic. If this structure is to remain, any dredging immediately adjacent to it could cause adverse affects. Therefore, the limitations assumed for this report should be followed. If these limitations are exceeded, then additional evaluation of this wall should be completed.

4.6.2 Bridge Abutments

There are four bridge crossings in this stretch of river. Starting at the upstream end is the Becher Street Bridge, moving downstream next comes the 1st Avenue Bridge, followed by a railroad bridge, and downstream is the Kinnickinnic Avenue Bridge. The abutments are primarily mass concrete structures in good condition. Based on their mass alone, it is unlikely that limited dredging would affect these structures; however, upon determination of dredging limits, these abutments should be reviewed in detail to assure their stability.

4.6.3 Boat Slips

Adjacent to Parcel 429 are permanent boat docks or boat slips constructed of timber and founded on 9" diameter steel piles driven into the river bottom. Also in the vicinity of the slips is a hoist founded on steel piles for lifting the boats from the river. Any dredging immediately adjacent to these structures would likely affect them adversely. Upon determination of the dredging limits, these piles should be reviewed in detail to assure their stability.

5.0 Recommendations

5.1 General

The following recommendations are based on the conclusions arrived at in Section 4.0 of this report. To develop more conclusive recommendations additional investigation and analyses are required. The recommendations are listed according to type of structure and match the outline of Section 4.0 of this report.

5.2 SSP Walls

If the limits of the dredging are more extensive than assumed for this report, the following work tasks are recommended as part of a more detailed analysis.

- Complete or research soil borings in the vicinity of the SSP walls to determine the soil types and layers adjacent to the wall.
- Complete a detailed analysis of the wall to determine if the planned excavation limits will adversely affect the global stability of the wall.
- Complete a detailed analysis of the wall to determine if the new loading conditions will overstress any members of the wall such as the anchor rods, wales, and steel sheet piles.

Final dredging limits should be used to complete the detailed analyses.

5.3 Wakefield Timber Walls

The Wakefield timber walls are generally in poor condition and should be protected during dredging operations. The recommended means for strengthening these walls is to construct new SSP walls immediately adjacent to the existing timber walls. The new walls would remain in place as permanent structures. Depending on site constraints and loading, the walls could be either anchored or cantilevered SSP walls. The approximate length requiring protection is 450 feet. The new steel SSP sheets will be approximately 40 feet long based on the records for existing SSP walls along this area of the river. At a cost of $20 per square foot (based on recent bid tabs), this equates to a protection cost of $360,000. Add in costs for fill material and contingency and the total protection cost is on the order of magnitude of $500,000. This estimate is preliminary and actual costs will be affected by site conditions, final design, and market conditions.

5.4 Wakefield Timber Walls with Concrete Cap

These walls are in poor condition and should be strengthened similarly to the plain Wakefield timber walls. The recommended protection method is the same as mentioned in Paragraph 5.3. The approximate length requiring protection is 535 feet. Using 40-foot sheets at $20 per square foot, the wall cost is $428,000. Add costs for fill and contingency and the total protection cost is on the order of magnitude of

$600,000. This estimate is preliminary and actual costs will be affected by site conditions, final design, and market conditions.

5.5 Concrete Wall

If the limits of the dredging are more extensive than assumed for this report, the following work tasks are recommended as part of a more detailed analysis.

- Search for records on the wall design and construction so that it can be analyzed.
- Complete or research soil borings in the vicinity of the wall to determine the soil types and layers adjacent to the wall.
- If records are found, complete a detailed analysis of the wall to determine if the planned excavation limits will adversely affect the stability of the wall.

Final dredging limits should be used to complete the detailed analyses.

5.6 Miscellaneous Structures

Upon finalizing the limits of the dredging, any structures within the vicinity of the excavated channel should be evaluated in detail to determine if dredging will affect their stability. The following recommended tasks should be completed in order to evaluate the structures appropriately.

- Search for records on the design and construction of the structure.
- Complete or research soil borings in the vicinity of the structure to determine the soil types and layers adjacent to the wall.
- If records are found, complete a detailed analysis of the structure to determine if the planned excavation limits will adversely affect the stability of the structure.

6.0 Summary

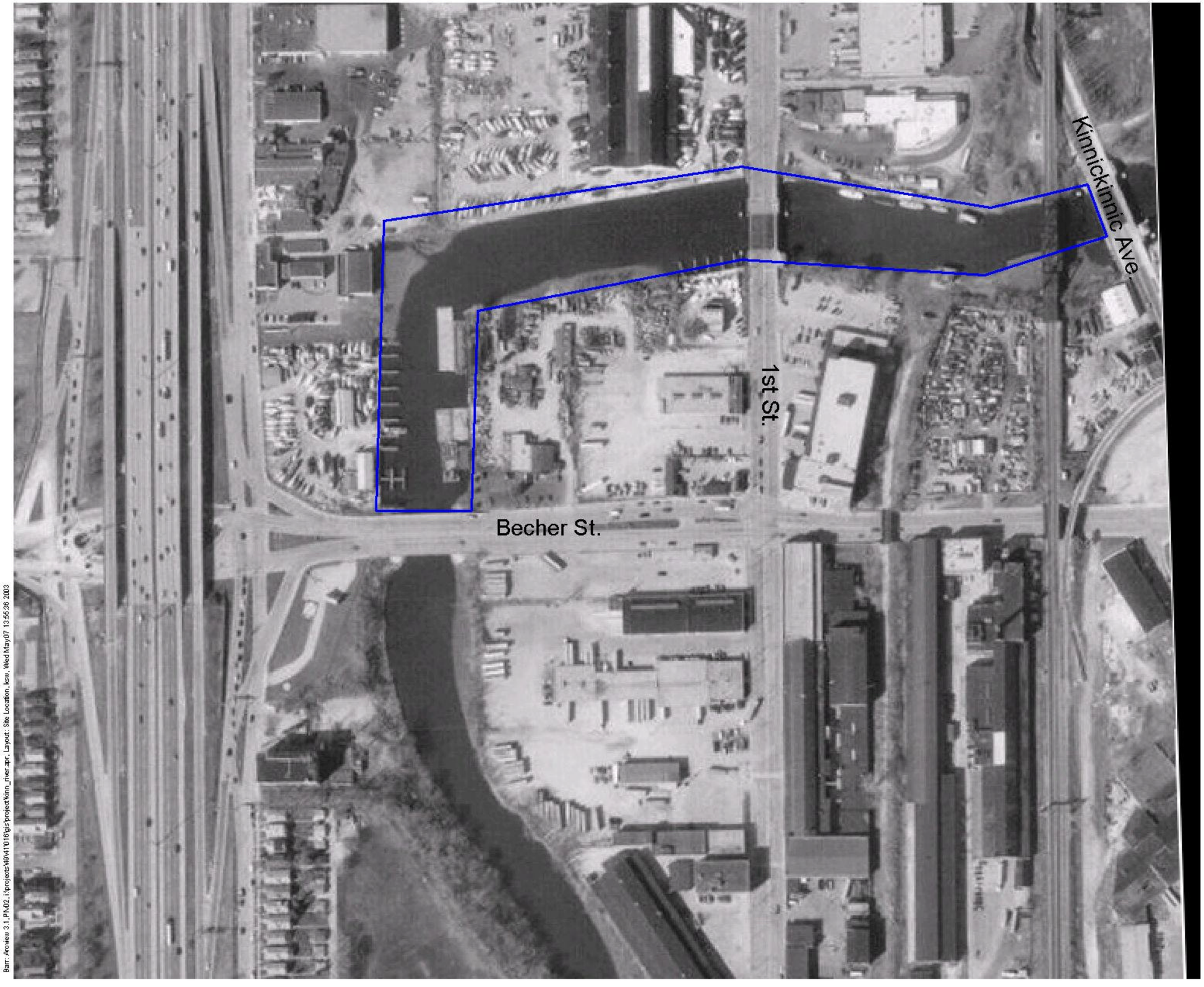
The seawalls along the Kinnickinnic River between Becher Street (upstream) and Kinnickinnic Avenue (downstream) are in poor to excellent condition. There are four types of walls; SSP wall, Wakefield timber wall, Wakefield timber wall with concrete cap, and concrete wall. Based on the assumptions included with this report, the SSP wall sections and concrete wall section are stable for the load conditions after dredging the channel. The Wakefield timber walls need to be replaced with new SSP walls as part of any dredging activity.

In order to confirm the assumptions of this report and complete a detailed analysis of the SSP walls, concrete wall, and miscellaneous structures within this stretch of river, additional tasks must be completed. These tasks include the following.

- Determine depth and width limits of dredge channel.
- Determine soil types in vicinity of walls and structures.
- Research record documents for walls and structures not found as of the time of this report.
- Complete detailed analyses for structures in question.

Seawall Condition Summary Table

Parcel Number	Wall Type	Length (feet)	Depth (feet)	Condition
429	SSP	385	34	Good
428	Unprotected	83	NA	NA
427	Unprotected	256	NA	NA
426B	Wakefield	292	28	Fair
426A	Wakefield w/ concrete cap	385	28	Fair to Good
426	Bridge abutment	NA	NA	Excellent
425	Timber w/ concrete cap	693	Unknown	Poor
432	SSP	51	Unknown	Excellent
433	SSP	556	25 or 46	Good
436	Unprotected	233	NA	NA
437	Concrete	152	Unknown	Good
438	Bridge Abutment	NA	NA	Excellent
439	Unprotected	238	NA	NA
440, 441, 442, 443	Unprotected	519	NA	NA



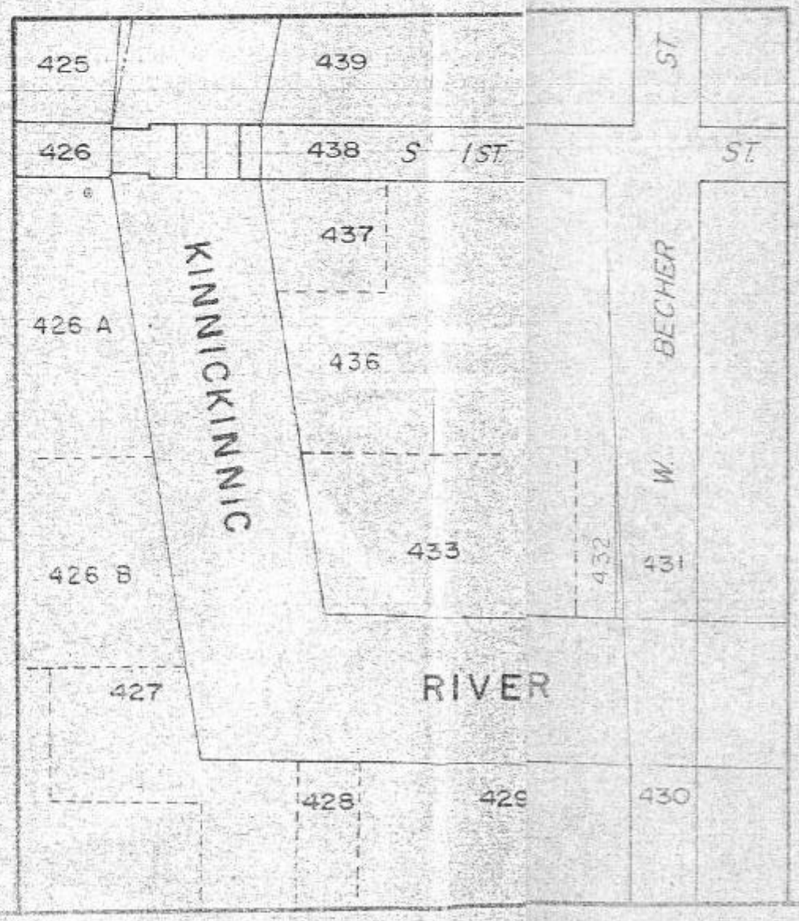
Remediation Area

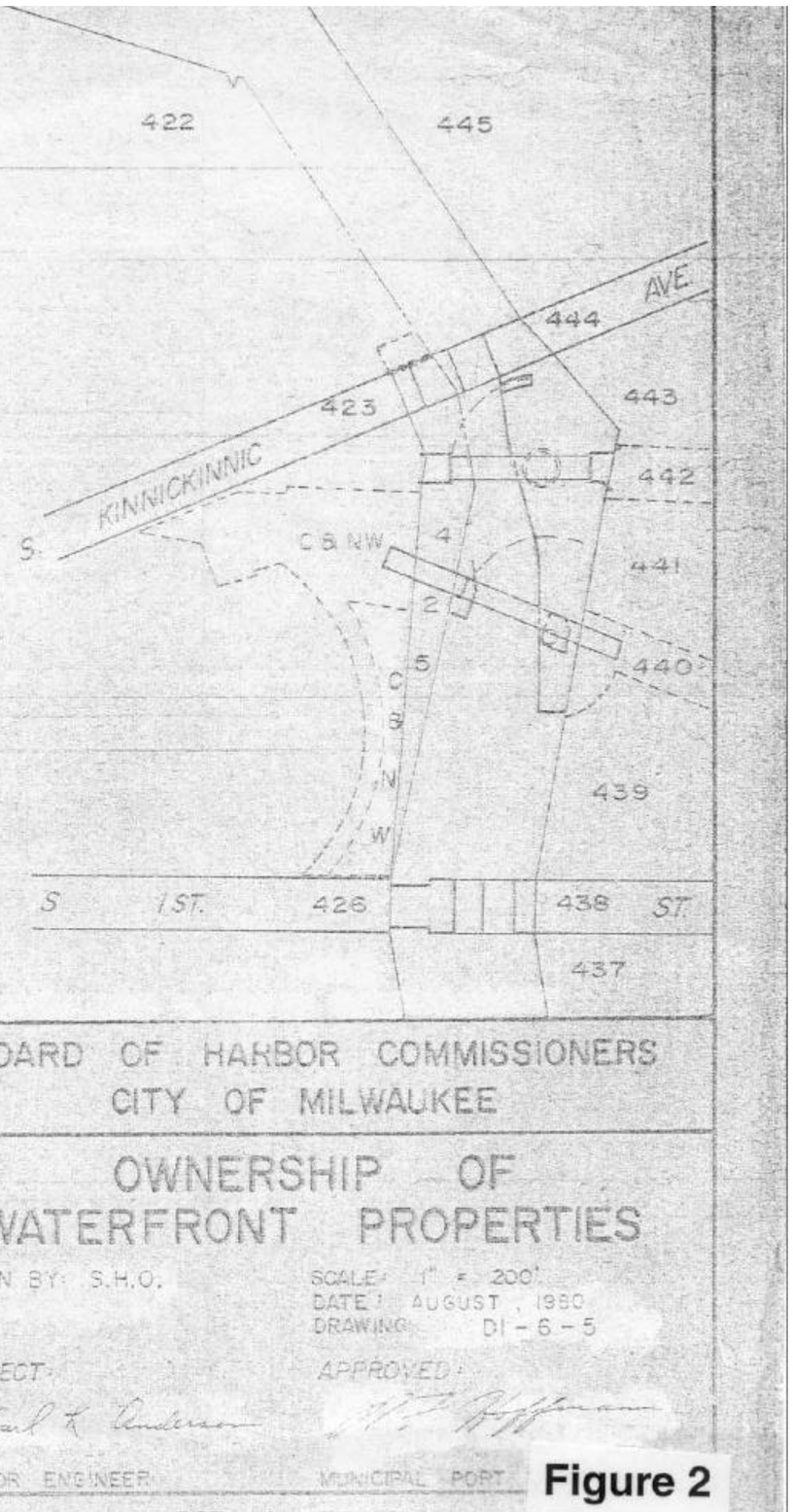
200 0 200 Feet

N

Figure 1
Site Location
Kinnickinnic River
Sediment Removal Concept Plan
Milwaukee, WI

OWNER	LN. FT. DOCK
IL CAR	875
O.	112
O	1,778
ERAGE COMMISSION	





BOARD OF HARBOR COMMISSIONERS
CITY OF MILWAUKEE

OWNERSHIP OF WATERFRONT PROPERTIES

DRAWN BY: S.H.O.
SCALE: 1" = 200'
DATE: AUGUST, 1980
DRAWING: DI-6-5

CORRECT:
Earl K. Anderson
HARBOR ENGINEER

APPROVED:
MUNICIPAL PORT

SHEET 1 OF 9

Figure 2

Appendix B-A

Photographic Log

PHOTO 2 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Left abutment Becher Street Bridge showing concrete box stormwater outlet. Taken from boat in river while looking southwest.

PHOTO 1 – October 4, 2002 – Kinnickinnic River
Taken By Tor Hansen, Barr Engineering
Becher Street Bridge looking upstream (South)

PHOTO 4 –October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Steel sheet pile wall along Parcel 429. Looking west.

PHOTO 3 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Concrete box stormwater outlet and upstream end of steel sheet pile wall along Parcel 429. Taken from boat looking west.

PHOTO 6 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Steel sheet pile wall along Parcel 429. Looking west.

PHOTO 5 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Steel sheet pile wall along Parcel 429. Looking west.

PHOTO 8 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Steel sheet pile wall along Parcel 429. Looking west.

PHOTO 7 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Steel sheet pile wall along Parcel 429. Looking west.

PHOTO 10 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Downstream end of steel sheet pile wall along Parcel 429 and upstream end of Parcel 428 showing vegetative cover at shoreline. Looking west.

PHOTO 9 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Steel sheet pile wall along Parcel 429. Looking west.

PHOTO 12 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Vegetation at shoreline along Parcel 428. Looking west.

PHOTO 11 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Vegetation at shoreline along Parcel 428. Looking west.

PHOTO 14 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Vegetation at shoreline along Parcel 427. Looking west.

PHOTO 13 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Vegetation at shoreline upstream end of Parcel 427. Looking west.

PHOTO 16 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Vegetation at shoreline along Parcel 427. Looking north.

PHOTO 15 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Vegetation and old timber wall in corner of Parcel 427.
Looking north.

PHOTO 18 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Upstream end of Parcel 426B with timber dock. Looking north.

PHOTO 17 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Vegetation at shoreline along downstream end of Parcel 427.
Looking north.

PHOTO 20 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Timber dock and wall along Parcel 426B. Looking north.

PHOTO 19 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Timber dock and wall along Parcel 426B. Looking north.

PHOTO 22 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Timber dock and wall along Parcel 426B. Looking north.

PHOTO 21 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Timber dock and wall along Parcel 426B. Looking north.

PHOTO 24 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Downstream end of timber dock and wall at Parcel 426B and upstream end of concrete dock and timber wall at Parcel 426A.
Looking north.

PHOTO 23 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Timber dock and wall along Parcel 426B. Looking north.

PHOTO 26 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Concrete dock and timber wall at Parcel 426A. Looking north.

PHOTO 25 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Concrete dock and timber wall at Parcel 426A. Looking north.

PHOTO 28 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Concrete dock and timber wall at Parcel 426A. Looking north.

PHOTO 27 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Concrete dock and timber wall at Parcel 426A. Looking north.

PHOTO 30 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Downstream face of pier and left abutment for 1st Street Bridge.
Parcel 426 looking north.

PHOTO 29 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Downstream face of pier and left abutment for 1st Street Bridge.
Parcel 426 looking north.

PHOTO 32 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Shoreline along Parcel 425. Looking north.

PHOTO 31 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Shoreline downstream from 1st Street Bridge left abutment. Parcel 425 looking north.

PHOTO 34 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Timber wall along Parcel 425. Looking north.

PHOTO 33 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Timber wall along Parcel 425. Looking north.

PHOTO 36 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Concrete and timber wall along Parcel 425. Looking north.

PHOTO 35 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Concrete and timber wall along Parcel 425. Looking north.

PHOTO 38 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Old bridge pier at shoreline along Parcel 425 downstream from Photo 37. Looking north.

PHOTO 37 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Vegetation along Parcel 425 downstream from Photo 36. Looking north.

PHOTO 40 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Railroad bridge abutment at downstream end of Parcel 425
downstream from photo 39. Looking north

PHOTO 39 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Vegetation at downstream end of Parcel 425. Looking north.

PHOTO 42 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Vegetation at shoreline upstream from Kinnickinnic Avenue left bridge abutment. Looking north.

PHOTO 41 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Railroad bridge abutment at downstream end of Parcel 425.

PHOTO 44 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Upstream face of left abutment and pier of 1st Street Bridge.
Looking downstream or east.

PHOTO 43 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Kinnickinnic Avenue Bridge left abutment. Looking northeast.

PHOTO 46 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Right abutment of Becher Street Bridge looking upstream or south.

PHOTO 45 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
1st Street Bridge looking downstream or east.

PHOTO 48 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Steel sheet pile wall along Parcel 433. Looking east.

PHOTO 47 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Steel sheet pile wall along Parcel 432 and upstream end of Steel sheet pile wall along Parcel 433. Looking southeast.

PHOTO 50 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Steel sheet pile wall along Parcel 433. Looking east.

PHOTO 49 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Steel sheet pile wall along Parcel 433. Looking east.

PHOTO 52 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Steel sheet pile wall along Parcel 433. Looking east.

PHOTO 51 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Steel sheet pile wall along Parcel 433. Looking east.

PHOTO 54 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Barge in front of steel sheet pile wall along Parcel 433. Looking east.

PHOTO 53 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Steel sheet pile wall along Parcel 433. Looking east.

PHOTO 56 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Steel sheet pile wall along Parcel 433. Looking south.

PHOTO 55 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Steel sheet pile wall at corner of Parcel 433 where river turns from northerly flow to easterly flow. Looking south.

PHOTO 58 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Downstream end of steel sheet pile wall at Parcel 433 and start of vegetation along Parcel 436. Looking south.

PHOTO 57 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Steel sheet pile wall along Parcel 433. Looking southeast.

PHOTO 60 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Vegetation at shoreline along Parcel 436. Looking south.

PHOTO 59 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Vegetation at shoreline along Parcel 436. Looking south.

PHOTO 62 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Upstream end of concrete wall at Parcel 437. Looking south.

PHOTO 61 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Vegetation at shoreline along Parcel 436. Looking south.

PHOTO 64 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Upstream face of right abutment of 1st Street Bridge. Looking southeast.

PHOTO 63 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Concrete wall along Parcel 437. Looking south.

PHOTO 66 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Vegetation along Parcel 439. Looking southeast.

PHOTO 65 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Vegetation along shoreline just downstream from 1st Street Bridge
along Parcel 439. Looking south.

PHOTO 68 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
New steel sheet pile construction adjacent to old bridge abutment at Parcel 440. Looking south.

PHOTO 67 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Upstream side of railroad bridge crossing river. Looking east

PHOTO 70 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Vegetation along shoreline at Parcel 441. Downstream from photo 69. Looking south.

PHOTO 69 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Vegetation along shoreline at Parcel 441. Looking south.

PHOTO 72 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Timber pile fence protecting bridge pier adjacent to Parcel 443.
Looking south.

PHOTO 71 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Upstream end of timber pile fence within river protecting bridge pier in front of Parcel 442. Looking southeast.

PHOTO 74 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Upstream side of Kinnickinnic Avenue Bridge and right abutment.
Looking east.

PHOTO 73 – October 4, 2002 – Kinnickinnic River
Taken by Tor Hansen, Barr Engineering
Upstream side of Kinnickinnic Avenue Bridge and left abutment.
Looking east.

AppendixB-B

Preliminary Seawall Stability Analysis

BARR ENGINEERING CO.

NAME TSH
DATE 10/10/02
SHEET _____ IN SET
PAGE _____ IN FILE

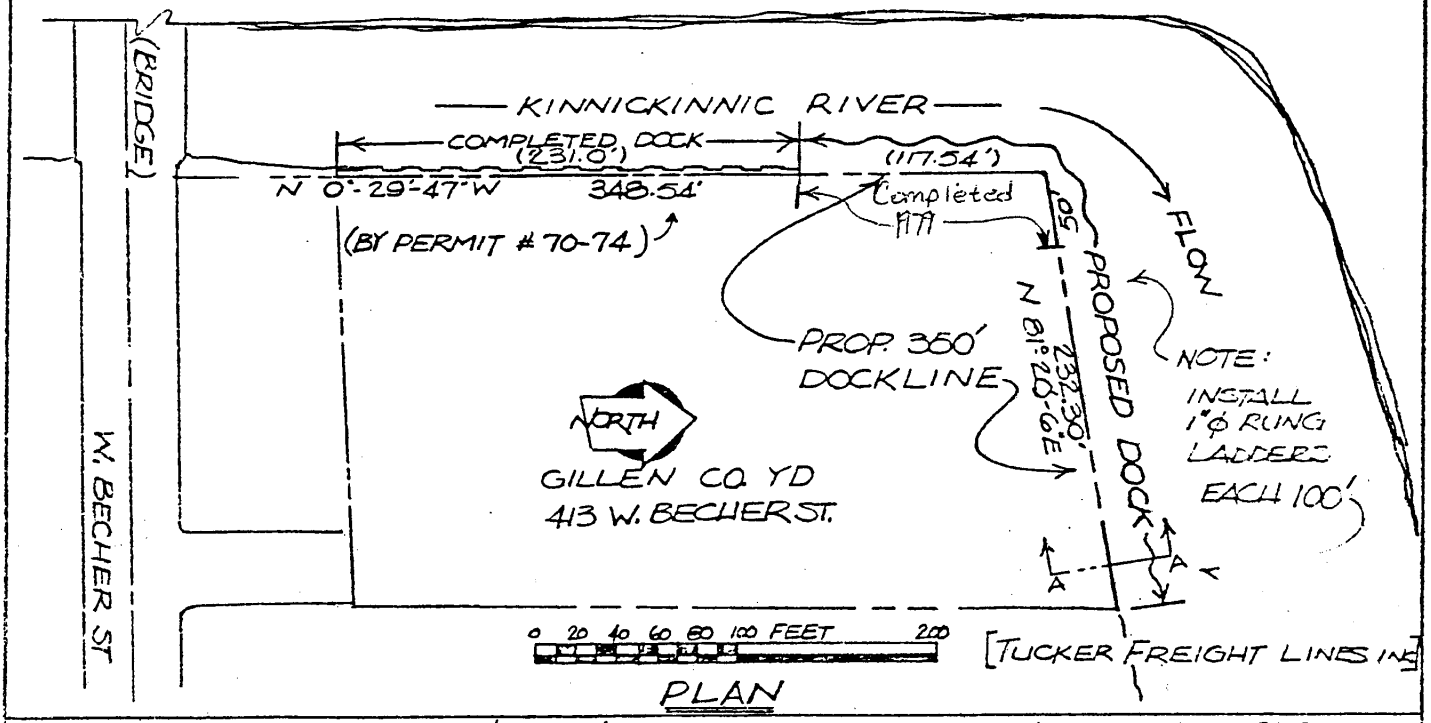
KINNICKINNIC SEAWALL

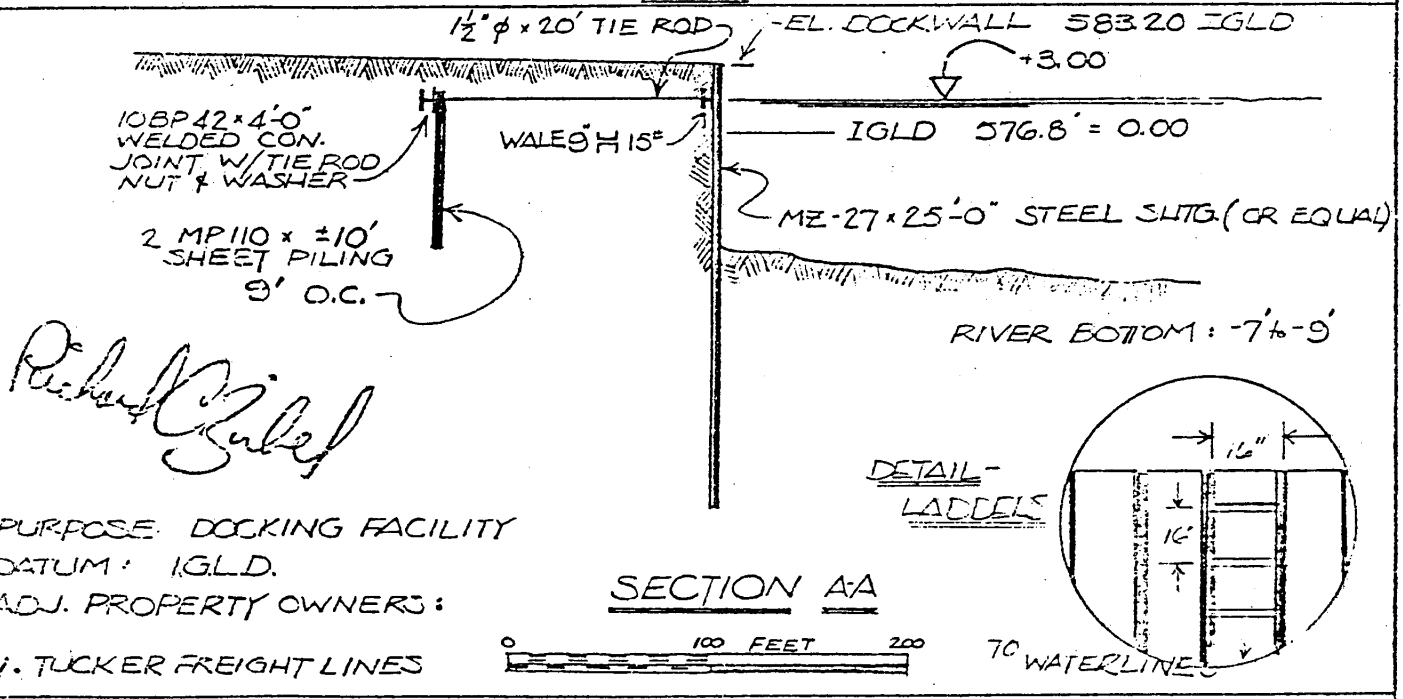
CHECKED BY _____
DATE _____

Summary of Conceptual Analysis

- Two cases run thru CWALSHT program
  - Baseline existing conditions
  - 8' dredge, 10' from wall
- Analyzed wall built under permit 219-C in 1979
- This wall only 25' deep, other walls 35' or 45' thus, this was worst case
- General wall layout shown on sketch, next page
- Soils assumed to be granular fill
- No soils info available
- $\phi = 32°$; $\gamma = 120$ PCF

DHH. For your information to be for possible inspection
(Ask For As Built Plans) E





PROPOSED DOCK RECON.

EE. GILLEN COMPANY

ON THE KINNICKINNIC RIVER IN MILWAUKEE, WISC. 25 JULY 1979

SHT. 1 of 2

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 10-OCT-2002 TIME: 9.38.21

INPUT DATA

I.--HEADING:
'KINNICKINNIC RIVER SEAWALL EVALUATION
'BASELINE CASE EXISTING CONDITIONS
'WALL CONSTRUCTED UNDER PERMIT NO. 219-C
'SHORTEST WALL OF RECORDS FOUND

II.--CONTROL
ANCHORED WALL ANALYSIS
SAME FACTOR OF SAFETY APPLIED TO ACTIVE AND PASSIVE PRESSURES.

III.--WALL DATA

ELEVATION AT TOP OF WALL	=	583.20	(FT)
ELEVATION AT ANCHOR	=	579.80	(FT)
ELEVATION AT BOTTOM OF WALL	=	558.20	(FT)
WALL MODULUS OF ELASTICITY	=	2.90E+07	(PSI)
WALL MOMENT OF INERTIA	=	184.00	(IN**4/FT)

IV.--SURFACE POINT DATA

IV.A--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	583.20

IV.B-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	568.80

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
120.00	120.00	32.00	.0	.00	.0				

V.B.-- LEFTSIDE LAYER DATA

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
120.00	120.00	32.00	.0	.00	.0				

VI.--WATER DATA

UNIT WEIGHT = 62.40 (PCF)
RIGHTSIDE ELEVATION = 576.80 (FT)
LEFTSIDE ELEVATION = 576.80 (FT)
NO SEEPAGE

VII.--SURFACE LOADS
NONE

VIII.--HORIZONTAL LOADS
NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 10-OCT-2002 TIME: 9.38.40

SUMMARY OF RESULTS FOR
ANCHORED WALL ANALYSIS

I.--HEADING

'KINNICKINNIC RIVER SEAWALL EVALUATION
'BASELINE CASE EXISTING CONDITIONS
'WALL CONSTRUCTED UNDER PERMIT NO. 219-C
'SHORTEST WALL OF RECORDS FOUND

II.--SUMMARY

RIGHTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

LEFTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

METHOD	:	FREE EARTH	EQUIV. BEAM	FIXED EARTH
FACTOR OF SAFETY	:	1.40	1.03	1.05

MAX. BEND. MOMENT (LB-FT)	:	-16658.	-6603.	-7258.
AT ELEVATION (FT)	:	570.55	572.69	572.48
MAXIMUM DEFLECTION (IN)	:	2.3528E-01	-4.0170E-02	6.4708E-02
AT ELEVATION (FT)	:	569.20	559.20	572.20
ANCHOR FORCE (LB)	:	3527.	1931.	2043.

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 10-OCT-2002 TIME: 9.44.54

INPUT DATA

I.--HEADING:
'KINNICKINNIC RIVER SEAWALL EVALUATION
'CHANNEL DREDGED 8-FEET WITHIN 10 FEET OF WALL
'WALL CONSTRUCTED UNDER PERMIT NO. 219-C
'WORST CASE WALL AS IT IS THE SHORTEST

II.--CONTROL
ANCHORED WALL ANALYSIS
SAME FACTOR OF SAFETY APPLIED TO ACTIVE AND PASSIVE PRESSURES.

III.--WALL DATA

ELEVATION AT TOP OF WALL	=	583.20	(FT)
ELEVATION AT ANCHOR	=	579.80	(FT)
ELEVATION AT BOTTOM OF WALL	=	558.20	(FT)
WALL MODULUS OF ELASTICITY	=	2.90E+07	(PSI)
WALL MOMENT OF INERTIA	=	184.00	(IN**4/FT)

IV.--SURFACE POINT DATA

IV.A--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	583.20

IV.B-- LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
.00	568.80
10.00	568.80
15.00	560.80
35.00	560.80

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE LAYER DATA

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
120.00	120.00	32.00	.0	.00	.0				

V.B.-- LEFTSIDE LAYER DATA

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
120.00	120.00	32.00	.0	.00	.0				

VI.--WATER DATA

UNIT WEIGHT = 62.40 (PCF)
RIGHTSIDE ELEVATION = 576.80 (FT)
LEFTSIDE ELEVATION = 576.80 (FT)
NO SEEPAGE

VII.--SURFACE LOADS
NONE

VIII.--HORIZONTAL LOADS
NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 10-OCT-2002 TIME: 9.45.03

SUMMARY OF RESULTS FOR
ANCHORED WALL ANALYSIS

I.--HEADING

'KINNICKINNIC RIVER SEAWALL EVALUATION
'CHANNEL DREDGED 8-FEET WITHIN 10 FEET OF WALL
'WALL CONSTRUCTED UNDER PERMIT NO. 219-C
'WORST CASE WALL AS IT IS THE SHORTEST

II.--SUMMARY

RIGHTSIDE SOIL PRESSURES DETERMINED BY COULOMB COEFFICIENTS
AND THEORY OF ELASTICITY EQUATIONS FOR SURCHARGE LOADS.

LEFTSIDE SOIL PRESSURES DETERMINED BY FIXED SURFACE WEDGE METHOD.

METHOD	:	FREE EARTH	EQUIV. BEAM	FIXED EARTH

FACTOR OF SAFETY	:	1.28	.97	1.00
MAX. BEND. MOMENT (LB-FT)	:	-14348.	-5890.	-6675.
AT ELEVATION (FT)	:	570.82	572.84	572.57
MAXIMUM DEFLECTION (IN)	:	1.9729E-01	-3.4246E-02	5.8226E-02
AT ELEVATION (FT)	:	570.20	559.20	572.20
ANCHOR FORCE (LB)	:	3149.	1768.	1911.